8.3.5.4 Unavoidable Adverse Impacts (Natural resources)

The department's road system will continue to require some use of nonrenewable materials. Although the rate of use is likely to decline, as described above, some quarrying and other operations will take place to allow the department to maintain its road system. Site-specific operations of quarrying will be analyzed and evaluated at the time by the Lands and Minerals Division.

8.4 BIOLOGICAL EFFECTS

8.4.1 Flora

8.4.1.1 Number and Diversity of Species

Logging can seriously affect the number and diversity of plant species and the types of vegetation that grow on state forest land. Plants are often crushed or uprooted and swept away by yarding.

Soil disturbance and compaction change growing conditions and therefore the types of plants that can grow on state forest land. Virtually all department harvest activities have the potential to influence flora and successional trees or plants.

Early successional stages in logged areas may also differ from those in areas undergoing natural disturbances. With time, however, the effect of logging decreases. Partial cutting appears to disturb existing vegetation less than clearcutting, though if multiple entries are used, these methods may have a detrimental impact on soils (see discussion of soils above.) Partial cutting may also encourage the spread of certain diseases to those residual stands.

Old growth forests differ significantly from young forests in species composition. Although few plant species are solely confined to old growth forests, many find optimum habitats there. Harvesting old growth forests will reduce these habitats and thus decrease the number and diversity of certain species.

1. Effects of Timber Harvest and Commercial Thinning

Clearcut harvesting significantly changes the forest environment. A 70-year old stand becomes a 1-year old seedling stand. The brush component changes accordingly. More short-lived, annual plants are present until the tree canopy closes in 12 to 30 years, depending on the species planted and the site.

Partial-cut harvesting also affects understory composition, depending on the species present and the size of the overstory opening. In some cases, the opening is followed by tree seedlings starting in the shade of large trees. In other cases, brush species (such as salal) fill the space. No matter what the timber harvest method, some changes in the numbers and diversity of species are likely at the site. Commercial thinning may also cause some of these effects.

The average rotation age of 60 years (which the department plans to use for the period of this plan and beyond) may also cause some change in nutrient cycling. Research, however, suggests that some forests are actually increasing in fertility and that growth declines, evident in some forests in the 1960s, can be attributed to the maturation of these forests or abnormal temperatures in recent years. More than 80 years of research on the growth and development of forests provide the scientific basis for the current department management. "The Pacific Northwest is one of the few places in North America in which the forest product industry logged the original forest and never left. Forest managers have invested in and already harvested substantial amounts of second forest. The third generation stands appear to have better growth than their predecessors." Quote from a paper by Philip S. Aune, et. al., a critique of Chris Maser's book, The Redesigned Forest (1988). The Aune paper is contained in section 3 of the public comment document.

2. Effects of Reforestation

Reforestation practices have the potential to reduce the number and diversity of species on state forest land. The department's practice has been to match the best-adapted trees to the particular site and to maintain native, genetic strains and species. (Where the department uses native seed sources, it has generally relied on the Tree Seed Zone map of Washington, published by the Washington Forest Tree Seed Council.) This practice deemphasizes reliance on seedling planting and leads to the combined use of natural reforestation and planting on areas that have been harvested.

In the past, Douglas-firs were planted to the exclusion of other species. The species was not well suited for every site and did not always survive. As a result, the department makes a careful effort to match the proper species with the particular site. In the department's Olympic region, for instance, about half of the harvested areas regenerate naturally with Western hemlock and a variety of other species, including Western redcedar, Sitka spruce, Pacific silver fir and red alder.

The department also recognizes the value of natural openings in stands for wildlife and other fauna. No reforestation effort has ever completely stocked every acre of a large stand. Naturally-occurring forests have openings and voids, and these openings are beneficial in second and third growth forests as well.

Some species that depend on fire may not be well represented in young stands in the future. The reason is that the department has limited slash burning and also controlled wildfires. These species may require special monitoring in the future to ensure their survival.

The department's selection of harvest technique will determine to a large extent what type of tree will make up the next stand. Shelterwood harvest, for example, is a type of partial cut that leaves between 20 and 40 trees per acre. It will favor shade-tolerant trees such as true firs. A clearcut harvest will favor shade-intolerant species such as Western larch or Douglas-fir. In addition, different harvest techniques can expose soil for natural seedlings or leave advanced regeneration (small trees already established) that are free to grow after the harvest of the overstory.

3. Effect of Precommercial Thinning

Precommercial thinning can also change the numbers and diversity of species. A thinning that cuts all species except one limits diversity. The department will ensure that precommercial thinning allows a variety of species to remain at the site. The department estimates it will use precommercial thinning on about 7,500 acres per year in the 1990s.

4. Effect of Vegetation Control

The purpose of the department's vegetation control program is to prevent vegetation from dominating a crop of trees. In sites where softwoods (conifers) are the crop species, the department may attempt to suppress or eliminate hardwoods (such as alder or cottonwood). By design, the department's efforts are intended to reduce or eliminate certain plants from a forest plantation. Eradication is site-specific and temporary in most cases.

The department deemphasizes the use of herbicides for vegetation control. It anticipates applying herbicides to about 6,500 acres each year in the next decade. See **Table 22.** The department anticipates about half of this amount will be by ground application. Use of aerial herbicides is the least-preferred option. (See Policy No. 33, Control of Competing Vegetation).

The department has taken steps to ensure that its herbicide program will not affect non-target species of flora. The department has commissioned and conducted several studies that help it evaluate herbicide usage. These studies are cited in section 8.3.3.5, mitigation (water), page 184.

5. Effect of Forest Health Program

There is little chance that the department's Forest Health program, which is designed to control insects, pests and disease, will damage or eradicate plant species. The preferred policy (see Policy No. 9, Forest Health) commits the department to reduce the level of pesticides used when viable alternatives are available.

6. Effect of Fire Protection Program

The department's fire protection program may impact the number and diversity of plant species. Wildfires have been a significant part of the ecosystem in the Pacific Northwest for thousands of years. The forests of both Eastern and Western Washington are a result of wildfires altering plant successions. Some plant communities are dependent on wildfires for their continued existence.

The role of fire in forests is varied, depending on the successional state, the conditions of vegetation and fuels, and the nature and frequency of fires. After severe fires, natural succession is usually retarded. Moderate or frequent small fires, however, may advance succession. Attempts to exclude fire from those forest ecosystems where organic matter does not rapidly decay have frequently altered the vegetation.

The cumulative effect of wildfire protection differs by area. In much of eastern Washington, for instance, where fires were frequent before European settlement (every 5-15 years), the department's fire prevention and suppression programs are changing the forest understory. Plant communities once dominated by grasses and fire-dependent shrubs are giving way to fire-intolerant shrubs and dense stands of conifers. As a result, oak woodlands, composed of a fire-tolerant species, are being encroached by Douglas-fir and other less fire-tolerant species.

In the absence of a fire protection program, the Douglas-firs would be destroyed during wildfires. (Because of this added protection, they restrict oak woodlands, which in turn affects some fauna, such as western gray squirrels, who live in the oak woodlands.)

In Western Washington coniferous forests, the cumulative impact of wildfire protection is more difficult to assess. The average interval of wildfires before the European settlement of the Northwest was approximately 350 years. Efforts to prevent and suppress fires have been made for only about 90 years. Fire frequency has increased dramatically with human activity in forested areas.

Fire retardant (ammonium phosphate) can act as a fertilizer in addition to controlling fire. Most of the ammonia nitrogen is rapidly converted to nitrogen by soil bacteria and is not likely to have any affect on the numbers or diversity of plant species.

8.4.1.2 Endangered, Threatened and Sensitive Species of Flora

The department is not aware of any federally endangered or threatened flora on state forest lands. The state, however, has identified candidate plants for possible listing by state or federal authorities. None is listed at the present time.

Although timber harvesting can reduce the number and diversity of some plant species, particularly in old growth areas, it also encourages habitat for many others species of flora.

Sizeable acres of old growth and mature timber will likely remain on department-managed land in the proposed Olympic Experimental State Forest, as well as in Old Growth Research Deferral Areas and in native gene pool reserve areas. In total, the department proposes to defer from harvest about 17,000 acres of old growth or mature older stands of timber. The deferral period extends for 10 or 15 years, depending on the location. (See Policy No. 6, Western Washington Ownership Groups, for a description of Olympic Experimental State Forest. See Policy No. 14 for information on Old Growth Research Deferral Areas.)

In addition, the department has deferred indefinitely 2,417 acres of gene pool reserves. See Policy No. 15, The Genetic Resource.)

8.4.1.3 Mitigation Measures (Flora)

The department will consider the following mitigation measures to protect flora:

1. Timber Harvest and Commercial Thinning

A variety of department practices and policies help mitigate the effects of timber harvesting and commercial thinning on fauna. The department intends to select the most appropriate harvest and reforestation method for the site (Policy No. 31, Harvest and Reforestation Methods).

In cases warranting special attention, the department will accept a reduction in income or return on investment when the department determines it is necessary to provide extra protection for certain nontimber resources, including special species of fauna (Policy No. 30, Silviculture Activities.)

Reducing the size and frequency of contiguous clearcuts in Western Washington will help mitigate the impact on floral species numbers and diversity. (See Policy No. 32, Green-Up of Harvest Units). The average clearcut size on state forest land is now about 72 acres. Although clearcuts larger than 72 acres are more economical, the trend on state forest land is to reduce clearcut size and use patch-cutting units when feasible. Patch cutting allows indigenous species to rapidly invade the clearcuts and begin the process of forest succession.

Because unique plant populations can be identified in advance of timber harvest, the department can mitigate adverse impacts of logging by avoiding those areas where populations are detected. Impacts to flora will be less with proper selection of site preparation methods that reduce soil compaction and herbaceous layer disturbance.

The department also believes that establishing riparian management zones will mitigate adverse impacts on flora. The zones can buffer the effects of logging on flora in the riparian environment in or near streams, lakes, ponds and other bodies of water. (See Policy No. 20, Riparian Management Zones.)

Without riparian management zones, some plant species would be damaged by logging and road construction. In addition to plants, the department attempts to retain larger trees and snags for wildlife. Finally, the department's policy of "no-overall net loss of wetlands" will also offer mitigation to species of flora found in this environment. (See Policy No. 21, Wetlands.)

2. Reforestation

The department's preferred policy (No. 31) is to select the reforestation method that ensures adequate stocking, produces acceptable returns to the trust and integrates other objectives (such as diversity and environmental considerations) identified in the plan. Specific impacts on plant numbers and diversity will be evaluated at the time of timber sale planning.

3. Precommercial Thinning

The department will leave a variety of species on the site when it uses precommercial thinning. The department will use care to ensure that severed trees do not fall into streams or create forest debris in undesirable locations.

4. Vegetation Control

The department intends to reduce the use of herbicides for site preparation and control of competing vegetation. Most herbicides are applied with ground-based equipment. The department's vegetation control policy (Policy No. 33) describes the different methods and the selection process. Aerial application of herbicides is the last option used. Care is taken to buffer riparian management zones from herbicides.

5. Forest Health

The department did not use insecticides in the last decade. If these products need to be used in the 1990s, the department will conduct an environmental analysis at that time. Care is taken to buffer riparian managements zones from insecticides and to mitigate other adverse impacts. Specific mitigation measures will be identified if and when these products are used. (See Policy No. 9.)

6. Riparian Management Zones

Creating riparian management zones (Policy No. 20) to protect riparian areas will likely add to the numbers and diversity of flora. Most riparian areas have an entirely different composition of plant species than adjacent uplands. The areas can provide an important wet and humid microclimate for wetland plant communities.

Riparian areas typically contain a broad diversity of plant species, including cottonwood, while the forested uplands contain mainly Douglas-fir, hemlock and some brush species.

7. Identification of Special Lands

The department intends to identify special lands that have special ecological features that fill critical gaps in ecosystem diversity (see Policy No. 13). It will seek legislation and funding to remove these lands from trust ownership. If endangered or threatened plants are found on state forest land, the department will attempt to use this mechanism to protect the area in question.

8. Gene Pool Reserves

Policy No. 15 (The Genetic Resource) requires the department to defer indefinitely from timber harvest approximately 2,417 acres of gene pool reserves (native seed sources). Gene pool reserves are 50 years of age or more but are not necessarily mature timber. These gene pool reserves have been removed from the commercial forest base to ensure that native genetic material, well adapted to local conditions, will be available to the department in the future.

8.4.1.4 Unavoidable Adverse Impacts (Flora)

Timber harvesting may decrease the diversity and number of flora on state forest land. Unique floral species may be unavoidably adversely impacted during these operations. This damage could occur by accident even after the department identifies the location of such plants, or the plants may not be identified and thus damaged during road construction, logging or other activity.

The department attempts to ensure that damage occurs as infrequently as possible.

Spray formulations of herbicides may burn or cause spotting of foliage and may also stunt plants, spot fruit or injure roots. The solvent in the spray mixture can also injure plants but these injuries are usually minor and do not normally affect the numbers or diversity of flora.

8.4.2 **Fauna**

8.4.2.1 Numbers and Diversity of Species

Timber harvesting can affect the numbers and diversity of terrestrial animals and fish. Proper harvest methods can reduce these impacts, but some changes in the numbers and diversity of species are probably inevitable in areas where there is a substantial amount of timber harvest activity.

Department activities are likely to have the following impacts on the numbers and diversity of terrestrial animals on state forest lands:

a. A reduction in the diversity of wildlife.

b. A reduction or local elimination of certain species that use older forests.

c. A reduction or local elimination of certain species that use hardwoods, when the timber is converted from hardwood to softwood (conifer).

d. Substantial changes in patterns of wildlife use and productivity because of road construction and use.

Timber harvesting may also affect the number of fish in streams adjoining harvested areas. The greatest influence on aquatic systems occurs when timber is harvested near rivers, streams, lakes and other water bodies. In small streams, timber harvest can cause sedimentation of streams and destroy or damage spawning grounds.

In addition, fertilization may impact streams and water quality, thus affecting the diversity and number of fish. In some instances, the effects of increased nitrogen on stream habitat and associated aquatic organisms may contribute to the eutrophication of ponds, lakes and slow-moving streams. However, research has shown that increases in nitrogen following forest fertilization are well below toxic levels for aquatic life. See "The Effects of Forest Fertilization on the Water Quality of Sund Creek (1989)," unpublished paper by James A. Ryan, Department of Natural Resources (available though the Forest Land Management Division), which is adopted here by reference.

Road construction and logging, site preparation, seedling planting and precommercial thinning may also affect fauna on state forest land. Site preparation, for instance, can destroy or reduce residual shrubs. The effect on forest animals can be beneficial or harmful, depending on the species and types and amounts of residue left.

Long-term habitat changes resulting from slash burning on certain specific sites are more significant than direct, short-term impacts. Destruction of residual shrubs, slash and logs eliminates cover and food for many birds and mammals. Loss of decaying logs and/or snags during site preparation may be especially harmful to some fauna. For these and other reasons, the department is deemphasizing the use of slash burning. It is now used only infrequently by the department (about 500 acres per year or less, equivalent to 1.6 percent of the total acres likely harvested each year).

Finally, precommercial thinning may have two different and somewhat contradictory impacts on terrestrial animals. On one hand, precommercial thinning may simplify tree species composition, further reducing the variety of animals the stand can support. On the other hand, opening up the tree canopy and increasing light penetration is potentially beneficial to many other species.

8.4.2.2 Habitat

The department's activities may have the following general impacts on these specific habitats:

1. Riparian Habitat

Timber harvest affects fish and wildlife habitat in rivers when logging occurs near a stream bank, increasing the influx of heat and light into the stream. The magnitude of timber harvest impacts varies inversely with width and density of buffer zones along streams. The larger the buffer zone, the less impact timber harvesting has on fish or wildlife habitat.

Beneficial impacts from increased light can sometimes outweigh adverse impacts of siltation and heating from timber harvest along small streams but this is not the case in larger streams in Western Washington. In larger streams, plant and animal production drops back to pre-logging levels only 10 to 20 years after logging, while temperature returns halfway to pre-logging levels two years after logging.

Timber harvesting and other forest practices also cause sedimentation and turbidity, the most widespread and persistent adverse impacts on stream habitat. Sedimentation has chronic, cumulative adverse impacts on downstream life; few beneficial impacts have been identified.

Riparian areas, as described in section 7.4.2.2 (existing environmental conditions), provide critical fish and wildlife habitat. Salmon (for example, steelhead and chinook salmon), nonsalmonid fish (sculpins, dace) and shellfish (crayfish, freshwater clams) are all dependent on diverse and vegetated riparian areas. Riparian areas provide important habitats for a large number of animal species. Deer and elk use riparian areas for calving. Approximately 41 species of Washington and Oregon wildlife use riparian zones or wetlands as special or unique habitats. Some species, such as the spotted frog, aquatic beaver, muskrat and many waterfowl, are totally dependent upon riparian or wetland areas. Amphibians like the pacific giant salamander live their whole lives in riparian areas. Many wildlife species also rely on the riparian zone for all or a major part of their lives. Riparian zones provide cover and a major source of food organisms and water. Other wildlife species use riparian areas for reproduction and the initial rearing of young.